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No. 64—1913.

British Engineering Standards Association.

(*Incorporated 1918*).

FORMED IN 1901 AS THE ENGINEERING STANDARDS COMMITTEE

BY

THE INSTITUTION OF CIVIL ENGINEERS.
THE INSTITUTION OF MECHANICAL ENGINEERS.
THE INSTITUTION OF NAVAL ARCHITECTS.
THE IRON AND STEEL INSTITUTE.
THE INSTITUTION OF ELECTRICAL ENGINEERS.

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BRITISH STANDARD SPECIFICATION FOR STEEL FISHBOLTS AND NUTS FOR RAILWAY RAILS.

LONDON:
PUBLISHED FOR THE ASSOCIATION BY CROSBY LOCKWOOD & SON,
7, STATIONERS' HALL COURT, LUDGATE HILL, E.C. 4; AND 5, BROADWAY, WESTMINSTER, S.W. 1;
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June, 1919.

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BRITISH ENGINEERING STANDARDS ASSOCIATION.

MAIN COMMITTEE.

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SIR MAURICE FITZMAURICE, C.M.G. (*Vice-Chairman*).

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SIR JOHN SNELL	Nominated by the Institution of Electrical Engineers.
COL. R. E. CROMPTON, C.B.	
MR. C. P. SPARKS	
MR. F. R. DAVENPORT	Co-opted by the nominated Members to represent the Federation of British Industries.
MR. F. W. GILBERTSON	
HON. SIR CHARLES PARSONS, K.C.B. ...	Co-opted by the nominated Members.
SIR ROBERT HADFIELD, BART.	
SIR RICHARD GLAZEBROOK, C.B. ...	

DR. J. H. T. TUDSBERY (*Hon. Secretary*).

MR. C. LE MAISTRE (*Secretary*).

MR. CHARLES DRESSER (*Assistant Secretary*).

* Succeeded the late SIR JOHN WOLFE BARRY, K.C.B., February, 1918.

BRITISH ENGINEERING STANDARDS ASSOCIATION.

The following are lists of Members of the Sectional Committee on Rails, and of the Sub-Committee on Railway Rails which was entrusted with the drafting of the Standard Specification for Steel Fishbolts and Nuts for Railway Rails.

SECTIONAL COMMITTEE ON RAILS.

August, 1913.

Chairman, MR. A. ROSS.

India Office, *Mr. G. V. Martyn.

Crown Agents for the Colonies, †Mr. G. L. Eyles, C.M.G.; Mr. Ashton M. Heath.

Institution of Municipal and County Engineers, Mr. Charles F. Wike (*City Engineer, Sheffield*); †Mr. W. Harpur (*Borough Engineer, Cardiff*).

Tramways and Light Railways Association, †Mr. Stephen Sellon.

Municipal Tramways Association, Mr. J. B. Hamilton.

Railway Engineers' Association, Mr. W. W. Grierson (*Great Western Railway*); Mr. E. C. Trench (*London and North Western Railway*).

Sir A. B. W. Kennedy (*Kennedy & Jenkin*); Mr. J. A. F. Aspinall (*Lancashire and Yorkshire Railway*); Mr. W. Evans (*Guest, Keen & Nettlefolds, Ltd.*); Mr. Brodie Henderson (*Livesey, Son & Henderson*); Mr. D. A. Matheson (*Caledonian Railway*); †Mr. A. S. Keith (*Walter Scott, Ltd.*); Mr. W. Howard-Smith; Mr. J. Wilson; Mr. W. B. Worthington (*Midland Railway*).

* Succeeded Mr. A. Brereton, C.S.I., April, 1913.

† Since deceased.

SUB-COMMITTEE ON RAILWAY RAILS.

August, 1913.

Chairman, Mr. W. B. Worthington.

Mr. A. Ross (*ex-officio*).

India Office, *Mr. G. V. Martyn.

Crown Agents for the Colonies, ‡Mr. G. L. Eyles, C.M.G.; Mr. Ashton M. Heath.

Railway Engineers' Association, Mr. W. W. Grierson (*Great Western Railway*); Mr. E. C. Trench (*London and North Western Railway*).

Mr. J. A. F. Aspinall (*Lancashire and Yorkshire Railway*); Mr. Arthur Dorman (*Dorman, Long & Co., Ltd.*); Mr. W. Evans (*Guest, Keen & Nettlefolds, Ltd.*); Mr. Brodie Henderson (*Livesey, Son & Henderson*); Mr. Henry Steel, Jun. (*Steel, Peech & Tozer, Ltd.*); Mr. Benjamin Talbot (*Cargo Fleet Iron Co., Ltd.*); †Mr. Seymour B. Tritton (*Rendel, Palmer & Tritton*); Mr. J. Wilson; Mr. W. Charles Wright (*Port Talbot Steel Co., Ltd.*).

* Succeeded Mr. A. Brereton, C.S.I., April, 1913.

† Succeeded the late Mr. F. E. Robertson, C.I.E., December, 1912.

‡ Since deceased.

PREFACE.

The Sectional Committee on Rails was appointed at a meeting of the Main Committee held on July 16th, 1901.

The Sub-Committee on Railway Rails was appointed at a meeting of the Sectional Committee on Rails, on October 31st, 1901. After completing the Standard Specifications and Sections for Bull Head and Flat Bottom Rails, the preparation of a Standard Specification and Sections for Steel Fishplates for use in conjunction with these Rails was undertaken. A request was subsequently received that a Standard should be drawn up for steel used in the manufacture of Railway Fishbolts and Nuts, and the preparation of a Standard Specification embodying tests both for the material and for the finished bolts and nuts was proceeded with. Information as to existing practice was obtained from British Railways and from the consulting engineers to some of the principal Indian and Colonial Railways, and upon the particulars so furnished the first draft of the Specification was prepared. This draft having received the careful consideration of the Sub-Committee was submitted to some of the principal Railway Fishbolt and Nut Manufacturers for criticism, and their views received attention prior to the Specification being forwarded to the Sectional Committee on Rails for approval.

The text of the Specification has been settled in consultation with the Committee by Mr. A. A. Hudson, K.C. (Standing Counsel to the Committee), with a view of ensuring that so far as practicable it has the meaning intended by them.

This Report was adopted by the Sectional Committee on Rails at their meeting on July 8th, 1913.

This Report was approved by the Main Committee at their meeting on July 17th, 1913.

Note.—*The Association desires to call attention to the fact that this Specification is intended to include the technical provisions necessary for the supply of the material herein referred to, but does not purport to include all the necessary provisions of a contract.*

BRITISH STANDARD SPECIFICATION FOR STEEL FISHBOLTS AND NUTS FOR RAILWAY RAILS.

Dimensions of Fishbolts and Nuts.

1. The Fishbolts and Nuts shall be made in accordance with the drawings to be supplied by the Engineer* (or by the Purchaser).

Process of Manufacture of Steel.

2. The steel for the Fishbolts and Nuts shall be of the best quality made by the acid open hearth or such other process as may be specified or approved by the Engineer (or by the Purchaser).

Tensile Test Pieces.

3. The tensile strength and ductility of the steel used in the manufacture of the Fishbolts and Nuts shall be determined from Standard tensile test pieces **C** or **D.** (See Appendix II., page 14.)

Tensile Test.

4. The steel used in the manufacture of Fishbolts and Nuts shall have an ultimate tensile strength of not less than 35 tons nor more than 40 tons per square inch, with an elongation of not less than 20 per cent. measured upon the Standard tensile test pieces **C** or **D.** (See Appendix II., page 14.)

Number of Tensile Tests.

5. One tensile test shall be taken from every five tons or under of the steel as rolled from which the Fishbolts and Nuts are to be manufactured.

Bend Test Pieces.

6. Bend test pieces may be taken from the bars (rounds and flats) as rolled and from the bolts before they are screwed.

---

* The word "Engineer" shall mean the Engineer or firm of Engineers supervising or acting as Engineer or Engineers in connection with the works for which the Fishbolts or Nuts are required or for the Purchaser.

Bend Test.

7. The bend test piece shall when cold be capable of being bent, either by pressure or by blows from a hammer, round a bar equal to its diameter or thickness until its sides are parallel, without showing any signs of fracture.

Number of Bend Tests.

8. One cold bend test shall be taken from every five tons or under of the steel as rolled from which the Fishbolts and Nuts are to be manufactured.

Quality of Fishbolts and Nuts.

9. The Fishbolts and Nuts must be perfectly sound, well finished, clean, and free from defects of any kind. The bolt heads shall be forged out of the solid, and the shoulders of the heads shall be exactly square with the axes of the bolts. The bearing faces of the Nuts shall, if so specified, be faced true in a machine. All threads shall be British Standard Whitworth (see Appendix I., page 12).

Submission of Samples.

10. Two sample Fishbolts and Nuts shall, if required or specified, be submitted to the Engineer (or to the Purchaser) and in such case the manufacture of the Fishbolts and Nuts shall not be commenced until these samples have been approved in writing both as regards dimensions and quality of workmanship.

Unscrewing Test.

11. All finished Fishbolts and Nuts shall be capable of passing the following tests for resistance to unscrewing. *1st Test*:—The Nut shall be screwed on to the Fishbolt until it is flush with the end of the Fishbolt, and a spanner of the kind mentioned hereafter shall then be affixed to the Nut in a horizontal position and weighted, as specified below. *2nd Test* —The Nut shall then be screwed further on to the Fishbolt until the end of the Fishbolt projects four threads beyond the face of the Nut, and the spanner weighted as before shall be again similarly applied to the Nut. Under each test the Nut shall carry neither less nor more than the minimum and maximum weights respectively specified in the following Table :—

Diameter of Fishbolt.	Test Weight in lbs.	
Inch.	Minimum.	Maximum.
Up to ¾	3	12
13/16 and ⅞	4	16
15/16 and 1	5	20

The spanner shall weigh 10 lbs., and the distance between the centre of the Nut and the point of suspension of the test weight shall be 3 feet.

Number of Unscrewing Tests.

12. So many Fishbolts and Nuts shall be tested for resistance to unscrewing as the Engineer (or the Purchaser) or the Inspector* may desire and select.

Selection of Test Pieces.

13. All test pieces and finished Fishbolts and Nuts shall be selected by and tested in the presence of the Engineer (or of the Purchaser) or of the Inspector.

Additional Tests before Rejection.

14. Should any of the test pieces first selected not fulfil the tensile and bend tests specified in Clauses 3, 4, 5, 6, 7 and 8, two additional test pieces may, with the approval of the Engineer (or of the Purchaser) or of the Inspector, be taken, and should either of them fail to fulfil such tests, the steel from the five tons or under from which the test pieces have been taken may be rejected.

The additional tests shall be carried out in the same manner in all respects as the tests hereinbefore required to be made in the first instance.

Inspection.

15. The Engineer, the Purchaser and the Inspector shall be at liberty to inspect the manufacture of the steel, the Fishbolts and the Nuts throughout all stages of the manufacture, and shall at all reasonable times have free access to the works of the Manufacturer and to all places under his control.

Testing Facilities and Place of Testing.

16. The Manufacturer shall at his own expense supply the gauges referred to in Clause 19, and shall supply and prepare all test pieces and supply all labour and apparatus for testing which may be necessary or which may be required by the Engineer (or by the Purchaser) for carrying out the tests and requirements of this Specification at the Manufacturer's works. If the Manufacturer shall fail to perform the foregoing obligations or any of them, the Engineer (or the Purchaser) shall be at liberty to perform the said obligations or any of them which the Manufacturer has failed to perform, either at the Manufacturer's works or elsewhere and charge the cost and expenses thereof to the Manufacturer.

Margin of Weight.

17. The actual weight of each Fishbolt and Nut shall not differ from the calculated weight by more than 2 per cent. above or below the calculated weight. If the actual weight is not more than 2 per cent. below the calculated weight, the actual weight only will be paid for, and if the actual weight is not more than 2 per cent. above the calculated weight, the calculated weight only will be paid for.

---

* The word "Inspector" shall include any person acting under the express written authority of the Engineer (or of the Purchaser).

Marking.

18. All Fishbolts shall be distinctly stamped on the heads with such letters and marks as may be required by the Engineer (or by the Purchaser).

Gauging.

19. The accuracy of each Fishbolt and Nut in every particular shall be determined by gauges approved by the Engineer, the Purchaser or the Inspector.

Non-compliance with Tests and Requirements.

20. Should the steel or any of the finished Fishbolts and Nuts selected for testing fail to comply with the foregoing tests and requirements, the Steel in the five tons or under from which the tests have been taken or the batch of Fishbolts and Nuts from which a selection has been made may be rejected).

Oiling.

21. The finished Fishbolts and Nuts shall be dipped into boiled linseed oil (hot or cold as may be specified or required by the Engineer or by the Purchaser).

Delivery.

22. No Fishbolts or Nuts shall be despatched from the Manufacturer's works until they have complied with the foregoing tests and requirements.

Arbitration.

23. In case any dispute shall arise between the parties to any contract in which this Specification is in whole or part incorporated as to whether any process of manufacture of the Steel specified or approved, or any test or requirement of this Specification, has or has not been carried out or complied with, then such dispute shall be referred to the arbitration of a person to be agreed upon between the parties, or failing agreement to be appointed, at the request of either party to the said dispute, by the Chairman for the time being of the Engineering Standards Committee, provided always that if such dispute is within the terms of any other agreement to refer or submit to arbitration this Clause shall be of no effect.

APPENDICES.

Appendix I. British Standard Whitworth Screw Threads.

Appendix II. Forms of British Standard Tensile Test Pieces.

APPENDIX I.

BRITISH STANDARD WHITWORTH SCREW THREADS.*

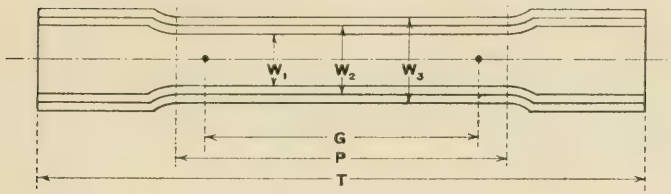
1	2	3	4	5	6	7
Full Diameter of Bolt.	No. of Threads per Inch.	Pitch.	Standard Depth of Thread.	Effective Diameter.	Core Diameter.	Cross Sectional Area at Bottom of Thread.
In.		In.	In.	In.	In.	Sq. In.
7/16 (·4375)	14	·07143	·04575	·3918	·3460	·0940
1/2 (·5)	12	·08333	·05335	·4466	·3933	·1215
9/16 (·5625)	12	·08333	·05335	·5091	·4558	·1632
5/8 (·625)	11	·09091	·05820	·5668	·5086	·2032
11/16 (·6875)	11	·09091	·05820	·6293	·5711	·2562
3/4 (·75)	10	·10000	·06405	·6860	·6219	·3038
13/16 (·8125)	10	·10000	·06405	·7485	·6844	·3679
7/8 (·875)	9	·11111	·07115	·8039	·7327	·4216
15/16 (·9375)	9	·11111	·07115	·8664	·7952	·4966
1	8	·12500	·08005	·9200	·8399	·5540

* Taken from Table I. of Report [No. 20, Revised February, 1913] British Standard Screw Threads.

APPENDIX II.

FORMS OF BRITISH STANDARD TENSILE TEST PIECES.

TEST PIECE **A.**

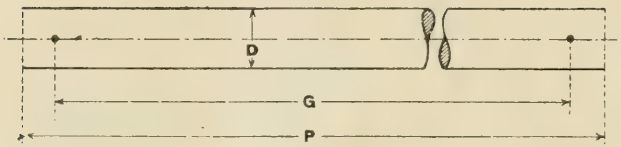


Gauge Length **G** = 8 inches.
Parallel Length **P** to be not less than 9 inches.
Total Length **T** = About 18 inches.

Thickness of Test Piece.	Maximum Width allowed.
Over $\frac{7}{8}$ in. (0·875 in.)	W_1 = $1\frac{1}{2}$ ins.
$\frac{3}{8}$ in. (0·375 in.) to $\frac{7}{8}$ in. (0·875 in.)	W_2 = 2 ins.
Under $\frac{3}{8}$ in. (0·375 in.)	W_3 = $2\frac{1}{2}$ ins.

The widths of the test pieces for plates were selected to comply with the two following conditions. (1) As the great bulk of plates to be tested are from $\frac{3}{8}$ inch to $\frac{7}{8}$ inch thick, it was desirable for the sake of convenience that the test pieces for such plates should be of uniform width, and, in accordance with very general practice, a width of 2 inches was selected. (2) With a test piece of a given form, the percentage of elongation was found to be less for thick plates than for thin ones; with steel of the same quality in other respects it was desirable therefore to choose widths of test piece which would be slightly in favour of the thicker plates. This is secured with the widths selected for the Standard Test Piece of form **A.**

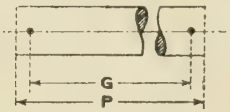
TEST PIECE **B.**



Gauge Length **G** to be not less than 8 times the diameter **D**.
With enlarged ends:—Parallel Length **P** to be not less than 9 times the reduced diameter **D**.

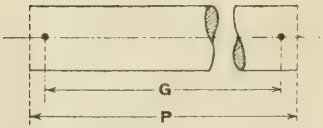
All test pieces of form **B** are strictly similar, and for the same material give the same percentage of elongation. They are nearly similar to a test piece of form **A**, 8 inches in gauge length, 2 inches wide and $\frac{3}{8}$ inch thick.

TEST PIECE **C.**



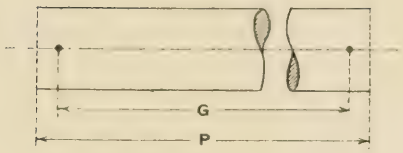
Gauge Length **G** = 2 inches.
Parallel Length **P** to be not less than $2\frac{1}{4}$ inches.
Dia. = 0·564 inch.
Area = $\frac{1}{4}$ sq. inch.

TEST PIECE **D.**



Gauge Length **G** = 3 inches
Parallel Length **P** to be not less than $3\frac{3}{8}$ inches.
Dia. = 0·798 inch.
Area = $\frac{1}{2}$ sq. inch.

TEST PIECE **E.**

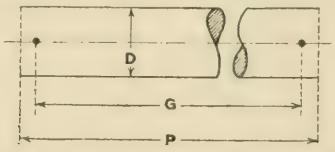


Gauge Length **G** = $3\frac{1}{2}$ inches.
Parallel Length **P** to be not less than 4 inches.
Dia. = 0·977 inch.
Area = $\frac{3}{4}$ sq. inch.

Test Pieces **C, D** and **E** were arranged to meet the very common practice of making test pieces for forgings, axles, tyres, etc., of either $\frac{1}{4}$ square inch or $\frac{1}{2}$ square inch in sectional area. With the gauge lengths decided upon, these three forms are very nearly similar, and, for a given material, give very approximately the same percentage of elongation. Though not exactly, they are approximately similar to the Standard Test Piece **F,** and for the same material give a nearly identical, but slightly greater, percentage of elongation.

TEST PIECE **F.**

(For Test Pieces over 1 inch diameter.)



Gauge Length **G** to be not less than 4 times the diameter **D.**
With enlarged ends:—Parallel Length **P** to be not less than $4\frac{1}{2}$ times the reduced diameter **D.**

In some testing machines it was found inconvenient to use form **B** for bars of over 1 inch in diameter, and form **F** of half the gauge length is designed to meet such cases. For a given material the percentage of elongation with test piece **F** is greater than with test piece **B,** and this difference is provided for in the British Standard Specifications.

FORM OF ENDS.

In the case of the round test pieces **B, C, D, E** and **F,** the form of the ends is to be as required in order to suit the various methods employed for gripping the test piece. When enlarged ends are used the length of the parallel portion of the test piece must in no case be less than that noted on the diagrams.

British Engineering Standards Association.

PRICE LIST

OF

BRITISH STANDARD SPECIFICATIONS AND REPORTS.

JUNE, 1919.

(*This List cancels all previous Lists.*)

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Printed by
Waterlow & Sons Limited, 49, Parliament Street
Westminster, London, S.W. 1.